N° 17,954 A.D. 1912

Date of Application, 2nd Aug., 1912—Accepted, 5th Aug., 1913

COMPLETE SPECIFICATION.

Improvements in the Distillation or Dehydration of Hydrocarbons or Liquids likely to form Froth or Foam.

I, JEAN ROSEN, of Apollo Lodge, Mapesbury Road, London, N.W., Consulting Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Certain liquid hydrocarbons such as coal tar, hydrated residues of naphtha, crude naphtha containing water, gelatine solutions and the like, cannot be heated in order to drive off the water they contain or for the purpose of distilling the same, without forming froth or foam that causes the boilers in which said hydrocarbons or liquids are treated to overflow.

The present invention relates to a process and apparatus for avoiding this drawback by reason of the froth or foam that is usually formed in such treatment.

In distilling and dehydrating hydrocarbons or liquids liable to froth or foam, the froth or foam formed is, according to this invention, directed towards a heating device, located above the liquid to be treated, by suitable partition walls, conduits or baffles and caused to spread out in thin layers whilst in contact with said heating device or after such contact.

In the improved apparatus there is produced and maintained above the liquid mass to be treated a higher temperature than that at which the liquid can rapidly and entirely be evaporated and distilled so that the unevaporated constituents contained in the froth or foam are instantly and completely distilled.

The improved process can be carried out in practice by the use of apparatus, several constructions of which are shown by way of example in the accompanying drawings; this apparatus will allow of all hydrocarbons being distilled without causing the liquid to overflow, each quantity of liquid that is converted into froth being subsequently replaced by a fresh quantity, so that by degrees all the liquid to be treated is eventually distilled.

The apparatus shown in Fig. 1 consists substantially of a boiler R containing a primary source of heat A for heating the mass M within a conical mantle C and producing froth in the centre only. The amount of liquid converted into froth is thus kept within a limited proportion and the whole mass of hydrocarbons is gradually heated and distilled, as the same freely communicates with the lower end of the conical mantle containing the heating device A. The mantle C guides the froth and brings the same into contact with a second comparatively stronger source of heat B which causes the froth to fall down onto baffle plates G3, G4 in the form of thin layers, so as to obtain a large surface and practically instantaneous complete evaporation.

The liquid to be treated may be agitated, for example a divided current of air or steam may be passed into the liquid.

The construction shown in Fig. 2 comprises a cylindrical boiler R that is properly encased with non-conducting material and is arranged over a furnace hearth for heating the liquid to be dehydrated or distilled. The liquid to be treated may be heated directly by the furnace or by means of a heating coil A placed inside the boiler. The second source of heat arranged above the liq-

[Price 8d.]

is constituted by a second heating coil B having a suitable inlet and outlet branch. A conical mantle of similar construction to the one shown in Fig. 1 serves to guide and spread out the froth in thin layers. The apparatus of Fig. 3 is constructed on the same lines as those of Figs. 1 and 2.

For introducing air or steam into the liquid mass in order to agitate the same and thereby facilitate the evaporation, a tube 7 is provided in Fig. 3 however that terminates within the boiler 1 in a perforated fixed or movable portion S located below the level of the liquid mass. An outlet 9 at the top of the boiler and an air inlet 12 at or near the lower part 2 of the boiler allow of continuing the distillation without increasing the heating. The hydrocarbons are supplied to the boiler 1 through a pipe 10. Several partitions or baffles 13 of tin plate and that are widened out at the bottom, may be arranged inside the boiler so as to limit the quantity of froth to be brought into contact with the coils 4 and spread the froth in thin layers so as to allow it to collapse and evaporate rapidly. Beneath or inside the baffles 13 coils 3 are arranged in which a suitable heating medium such as steam, hot oil, saturated solutions, is made to circulate. 5 is the inlet to the heating coil 4 and 6 the outlet therefrom.

In the construction shown in Fig. 4 the boiler 1 is divided into two compartments by a partition wall 13 that is perforated at its lowest part as shown. From the top of the inner compartment formed by the partition 13 there projects upwardly a conduit 14 provided with a hollow head 15 within which is located the heating coil 4 that is brought to a higher temperature than the liquid to be treated. The lower wall of the hollow head 15 is perforated to allow the condensed products to run out. Each compartment has fitted in its lower part a pipe 12 for introducing air, gas or carbonic acid for agitating the liquid when the latter is strongly heated. The inner compartment is furnished with a heating coil 3 and the outer compartment is furnished with a coil 16 for heating the said compartment with steam. The steam pipes are connected to a main steam supply pipe fitted with a three way cock so that steam can be passed into either of the coils 3 or 16 as desired for the purpose of heating the compartments as required. 11 is the outlet from the boiler.

As will be understood the boilers may be of any suitable shape.

The liquid to be treated is heated on the hearth or by means of the heating coils. The temperature of the liquid will gradually increase and the froth formed will rise through the conduit 14 to the hollow head 15. On coming into contact with the heating coil 4 that is heated to a higher temperature, the froth will fall down through the holes in the lower wall of said hollow head on to the liquid mass contained in the outer compartment. This compartment will then be heated in order to obtain the dehydration required as the holes provided in the partition 13 allow liquid to pass in and out from one compartment to the other. The partial or complete distillation may then be effected by increasing the admission of air at the air inlet branch 12.

Fig. 5 illustrates a construction that is similar to that shown in Fig. 4 except as regards the shape of the partition 13 which in this case is open at the top but provided with an external flange that extends to the wall of the boiler 1 so as to enclose an annular space within which the heating coil 16 is arranged. Instead of one conduit 14, two or more such conduits projecting upwardly from the flange, connect said annular space to the tubular head 15.

In the case of liquids that do not readily froth or foam or in order to increase the output of the apparatus the improved construction shown in Figures 6 and 7 can be used. This apparatus comprises a rectangular boiler 1 encased with non-conducting material and provided with one or two plate baffles 13 that are flanged outwardly at the lower part and between which a number of vertical heating coils 3 are arranged. Each vertical coil 3 is connected to an inlet branch 17 and to an outlet branch 18. Between the baffles 13 a number of vertical tubes 19 connect an upper heater or collector 20 having a steam supply 21, with a lower heater or collector 22 having an outlet 23, so that the

heating medium can be caused to circulate from top to bottom. The vertical tubes 19 are however supplementary and not indispensable in working the apparatus.

On each side of the upper part of the baffles 13 are arranged heating tubes 4 that constitute the second source of heat. These tubes are arranged in superposed alternating rows and in order to compel the froth to flow over them, baffles 26 are provided as shown. The tubes 4 are fixed at their ends in small receivers or headers from which the inlet and outlet branches 5, 6 extend to the exterior of the boiler.

The top of the boiler is provided at its underside with small channels 27 to run off the products condensed on the under surface of the boiler top into lateral collecting tanks 28 from whence the vapours and condensed products pass through outlet pipes 29 into the condensers.

The process in the apparatus shown in Figs. 6 and 7 is carried out as follows: A part of the liquid mass is rapidly heated on being brought into contact with the coils 3 and the tubes 19, the froth begins to form and a current is produced between the baffles 13 so that the froth rises and comes into contact with the upper tubes 4 and by the baffles 26 is caused to flow over all the tubes 4 and finally fall back into the liquid mass in the boiler 1 or to be condensed on the walls of the boiler.

If the liquid to be treated does not easily froth or foam the formation of the same can be facilitated by introducing air, steam or the like through perforated tubes 8.

In the constructions shown in Figs. 8, 9 and 10 the boiler 1 contains a partition or baffle 13 that extends longitudinally of the boiler and is shaped and arranged as shown in order to guide the froth in the desired way. The tubes 4 are superposed progressively and receive the liquid that flows over the shields 26.

Fig. 11 shows a simple construction of apparatus for a small plant comprising a cylindrical boiler with a conical baffle 13 and an outlet channel 28 for the condensed products, the heating tubes 4 being arranged as a coil (see Fig. 12) around the upper end of the conical baffle.

The heating of the coils is effected according to the temperature required by means of steam, hot oil or liquids boiling at a high temperature, the heating medium being made to circulate by means of a plunger pump arranged in the steam generator as shown in Fig. 13.

The heating is effected in a closed cycle and as the apparatus is efficiently protected with non-conducting material the temperatures required are obtained with a minimum loss of heat.

As will be understood, in the apparatus shown in Figs. 4, 5 and 11, the froth is caused to spread out in thin layers whilst in contact with the heating device, whereas in the apparatus shown in Figs. 1, 2, and 3 it is spread out in thin layers after such contact, and in the apparatus shown in Figs. 6, 7, 8, 9 and 10 the froth is spread out in thin layers after contact and whilst in contact with said heating devices.

It has already been proposed to provide an evaporator with upper and lower coils, steam for heating entering the upper coils first, which are located above the liquid, and afterwards flowing through the lower coils, which are located within the liquid, the upper and more highly heated coils being for intercepting and evaporating any liquid thrown up by ebullition and any moisture in suspension caused by such ebullition. It has also been already proposed to deliver heated liquid to the upper part of an evaporator chamber in a stream or streams that falls or fall upon a plate or a number of plates over which it flows in a thin film so that no frothing takes place.

It has also been already proposed to distil or evaporate liquids by heating the liquid under vacuum to convert it into froth or foam, transferring the said froth or foam to a second heating surface and heating under vacuum the froth or foam so transferred, the apparatus for effecting this comprising two evaporators of

the calandria type arranged one above the other in a vacuum chamber so that liquid under the influence of the lower evaporator foams or entrains through the tubes of the upper evaporator.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In distilling and dehydrating hydrocarbons or liquids liable to froth or foam directing the froth or foam formed towards a heating device located above the liquid to be treated, by suitable partition walls, conduits or baffles and causing it to spread out in thin layers whilst in contact with said heating device, or after such contact, substantially as described.

2. In distilling and dehydrating liquids as set forth in Claim 1, agitating the liquid to be treated as by passing into it a divided current of air or steam, substantially as described.

3. Apparatus for distilling and dehydrating liquids liable to froth or foam as set forth in Claim 1 comprising baffle plates for spreading out the froth substantially as described.

4. Apparatus according to Claim 3 in which the vessel for heating the liquid is divided into several compartments provided with suitable conduits for directing the froth to the upper heating device, substantially as described.

5. Apparatus according to Claim 3 in which the upper heating device comprises a chamber heated with steam and which is in communication by a suitable conduit or conduits with the various compartments of the heating vessel, substantially as described.

6. Apparatus according to Claim 3 wherein the upper heating device consists of a number of progressively superposed horizontal tubes arranged to produce a large contact surface for the froth formed, substantially as described.

7. Apparatus according to Claim 1 wherein for facilitating the distillation or abduction of the vapours, steam can be passed into the liquid through perforated tubes that are arranged within the liquid to be treated, substantially as described.

8. Apparatus according to Claim 3 comprising a receiver in which the condensed products are collected and from which they may be withdrawn for further treatment, substantially as described.

9. Apparatus for distilling and dehydrating liquids liable to form froth or foam, constructed and adapted to operate substantially as hereinbefore described with reference to and shown in the accompanying drawings.

Dated this 2nd day of August, 1912.

For the Applicant,
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Chartered Patent Agents.

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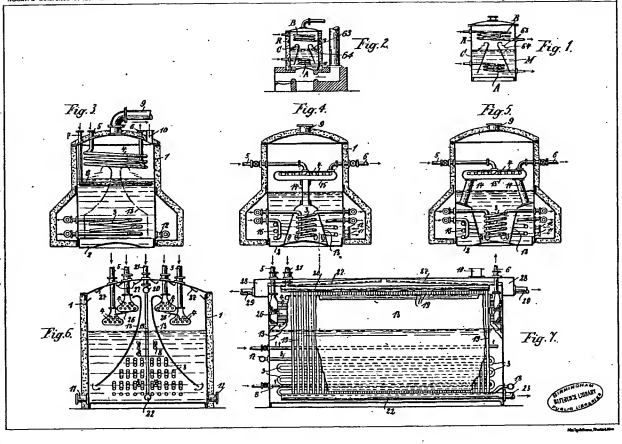
A.D. 1912. Aug. 2. N° 17,934.
ROSEN'S Complete Specification

(9 SHEETS)
SHEET 1.



[This Drawing is a reproduction of the Original on a reduced scale.]

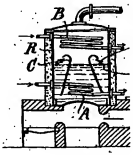


Fig. 3.

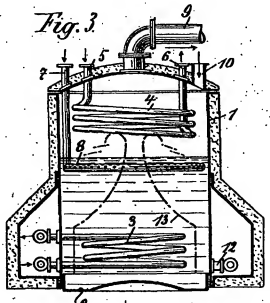


Fig. 4.

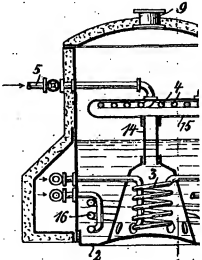
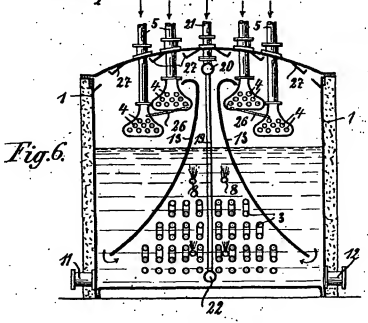
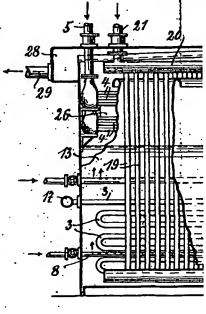


Fig. 6.





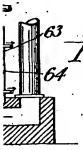


Fig. 2.

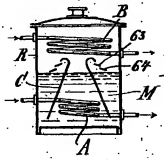
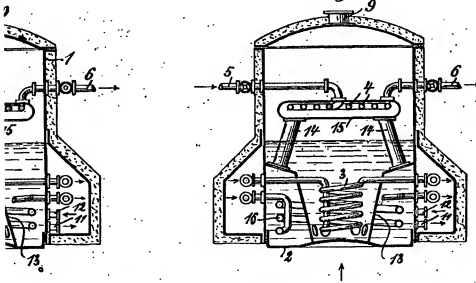


Fig. 1.

Fig. 5.



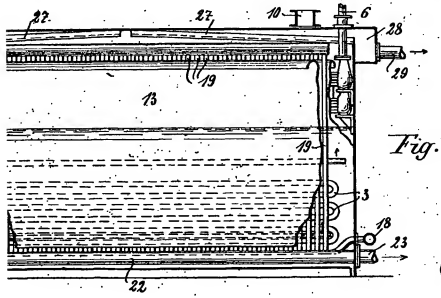


Fig. 7.

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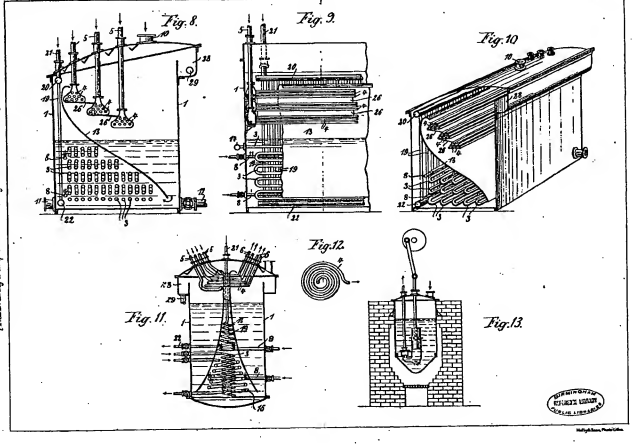


Fig. 8.

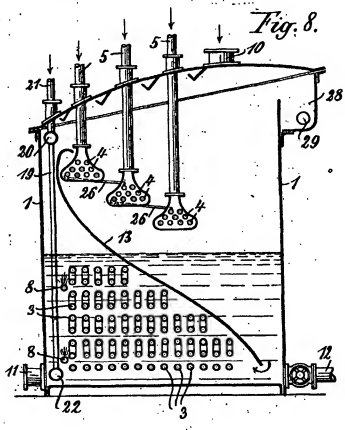


Fig. 9.

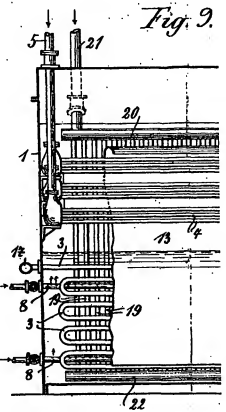


Fig. 11.

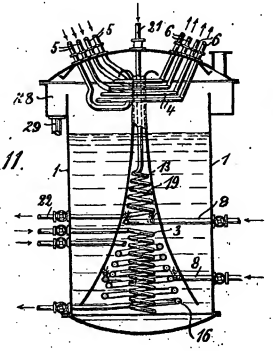


Fig. 1

9.

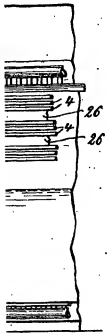
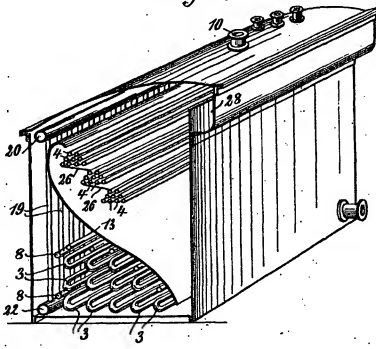


Fig. 10



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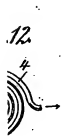

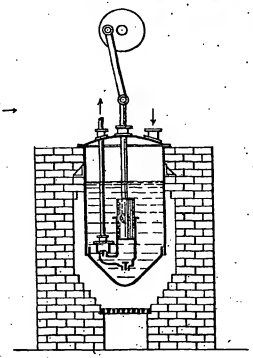

Fig. 13.

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